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ABSTRACT

The AzTEC Mathematics Project (AMP) is a statewide partnership among Arizona's Regents universities and state community colleges, partner school districts, and economic communities. AzTec is committed to preparing highly qualified K-12 mathematics and science teachers. AMP targeted Native American teachers and teachers of Native American students in northern Arizona. It emphasized aligning Arizona mathematics standards and district mathematics curriculum to the Arizona Science Standards and district/school curriculum. The goal was to help teachers integrate their mathematics and science curricula. AMP consisted of four full-day workshops on the Northern Arizona University campus and a culminating 4-day summer institute. Teachers earned 3 hours of graduate credit for completing the project. AMP helped teachers develop lessons for their classrooms that would place mathematics and science content in context with one another. Emphasis was on modeling integration of mathematics and science teaching. The culminating assignment was to develop an integrated lesson with an assessment component. Teachers had to teach the lessons in their own classrooms, reflect on the experience, then revise the lesson plans. At the summer institute, teachers brought their original and revised lesson plans and presented them to the class. (SM)

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THE AzTEC MATHEMATICS PROJECT (AMP)

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The AzTEC Mathematics Project

Professional educators have long realized the need to make clearer and stronger connections between areas of the curriculum. This is particularly critical in the teaching of mathematics. For too long, students have experienced mathematics as a collection of disjointed topics that one will need to know sometime in the future. The National Council of Teachers of Mathematics (NCTM, 2000) asserted in the Connections Standard that:

> Instructional programs from prekindergarten through grade twelve should enable all students to
>
> •recognize and use connections among mathematical connections among mathematical ideas;
>
> •understand how mathematical ideas interconnect and build on one another to produce a coherent whole;
>
> •recognize and apply mathematics in contexts outside of mathematics (p. 64).

The National Science Teachers Association (NSTA) affirmed that science standards include connections with mathematics, technology, social science, and history. *Project 2061* (1989) recognized that thematic ideas transcend the traditional boundaries of the sciences, technology, and other school subjects.

Meanwhile, throughout the nation most states are engaged in high stakes testing. The tests primarily focus on mathematics and reading. Even though most states have adopted state standards in science, the mandated tests have not included science as an area of focus. Unfortunately, this has negatively impacted the teaching of science particularly in the elementary grades. When science is taught in the elementary classroom, it is too often perceived as an add-on elective.

Elementary and middle school teachers often struggle to cover topics their students see no need to master. It is not surprising to find the need to reteach some of these topics year after year. Those teachers committed to teaching science are often frustrated when they discover their students do not have the prerequisite skills for a particular science activity.

The AzTEC Mathematics Project (AMP) was developed to address these issues. AMP was a sub-grant funded by the Arizona Teacher Excellence Coalition (AzTEC). AzTEC is a statewide partnership among Arizona's Regents universities (Northern Arizona, Arizona State University, and University of Arizona) and state community colleges, partner school districts, and economic

communities. Funded for 13.7 million dollars over five years, AzTEC is committed to preparing highly qualified mathematics and science teachers for K-12 classrooms.

AMP targeted Native American teachers and teachers of Native American student populations within the northern Arizona region. The project focused on aligning Arizona Mathematics Standards and district mathematics curriculum to the Arizona Science Standards and district/school curriculum. The goal was not to develop new curriculum materials. Teachers already feel overwhelmed by the curriculum to be taught. The goal was to help teachers integrate the mathematics and science curricula already mandated by their school and district. AMP consisted of two major phases. Phase one consisted of teachers coming to the Northern Arizona University campus for four full day workshops. Teacher incentives included substitute reimbursement for the district, lunches each day, and professional development. Phase two was a culminating four-day summer institute. The teachers earned three hours of graduate credit upon completion of the project and attendance at the summer institute. At the summer institute the teachers also completed an order for $125 of mathematics and science materials

for their classrooms. Fifteen teachers accepted the invitation to participate during the spring semester of 2001. They came to campus on four Fridays for an all day in-service and returned for a four day institute in the summer.

AMP assisted teachers in developing lessons for their classrooms that would place mathematics and science content in context with one another. As the mathematics component was taught, students would see an immediate application and connection with the science component. Mathematics concepts would not be isolated topics to the students. The students would have the prerequisite mathematics skills to successfully complete the science activity. Both areas of the curricula would be strengthened.

Emphasis was on modeling integration of mathematics and science teaching. During the morning session, a particular mathematics concept from the Arizona Mathematics Standards was selected as the focus topic. A model lesson was presented to the teachers presenting this topic in two formats. First, a lesson was presented which introduced this concept for the first time. Next, a lesson was presented which reviewed this concept for older students

who may have previous knowledge or experience with the topic. Following lunch, a science lesson was presented which applied the mathematics concept of the morning. The lessons were taken from *40 Strategies for Integrating Science and Mathematics Instruction* (Eichinger, 2001).

Each session time was designated to allow teachers to discuss their experiences teaching the mathematics and science topics. This was a particularly enriching segment of the day as it brought the entire group together as a community of learners. In later sessions, teachers became open and shared not only positive experiences but also their failures and frustrations. Many teachers later reflected in their final evaluations that they had valued this component as one of the most beneficial of the project.

The culminating assignment due in July for the participants was the development of an integrated lesson. Each teacher was to select a topic that integrates mathematics and science and identify the mathematics and science standards addressed. A lesson plan was developed to teach the concept(s) for one or more days. The lesson plan was to include materials, procedures, and could follow

whatever format was used in the teacher's school. Each lesson had to also include an assessment component.

Each teacher was to teach the lesson in his/her own classroom. After teaching the lesson, the teacher was to reflect on the experience. What went well? What did not go well? What would the teacher do differently the next time they taught the lesson? Did the assessment indicate that the lesson objectives were met? What did the teacher learn after teaching the lesson? The teacher was then to revise the lesson plan with all these things in mind.

On the last day of the spring in-service, the participating teachers were able to order $150 of mathematics and science materials for their classroom. Teachers particularly appreciated the freedom to select materials on their own. The teachers were presented their orders on the last day of the summer institute.

When the teachers returned to campus for the four-day summer institute they were to bring the original and revised lesson plans. Each teacher presented his or her topic to the class in a 20-minute presentation and turned in to the teacher the following in a folder: the original lesson plan, reflection of the lesson, and revised lesson plan. Assessment of the unit was on a 1-5 scale based on

content, completeness, neatness, grammar, and professionalism. Teachers were given the opportunity to make copies of units they felt were applicable or adaptable to their grade levels. Completion of the summer institute resulted in each teacher receiving three hours of graduate credit.

The summer institute also included field trips on two mornings to The Arboretum of Flagstaff and to the hands-on children's museum at Lowell Observatory. The teachers worked with educational staff at each facility that showed how each site could be used as an extension of the classroom for a meaningful educational field trip.

Granted, this is but one small project. Hopefully, from this project and similar endeavors, attempts to improve mathematics and science teaching will continue.

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